Development of Electronics for Low Temperature Space Missions

Richard L. Patterson
NASA Glenn Research Center
Mail Stop 301-5
Cleveland, Ohio 44135 USA
Tel: (216) 433 - 8166
Fax: (216) 433 – 8311
Richard.Patterson@grc.nasa.gov

Ahmad Hammoud
Dynacs / NASA Glenn Research Center
(216) 433-8511
Ahnad.Hammoud@grc.nasa.gov

Scott Gerber
Dynacs / NASA Glenn Research Center
(216) 433-8059
Scott.Gerber@grc.nasa.gov

John E. Dickman
NASA Glenn Research Center
(216) 433-6150
John.E.Dickman@grc.nasa.gov

Eric Overton
NASA Glenn Research Center
(216) 433-8648
Eric.Overton@grc.nasa.gov

ABSTRACT
(for oral presentation)

The operation of electronic systems at cryogenic temperatures is anticipated for many future NASA space missions such as deep space probes and planetary surface exploration. For example, an unheated interplanetary probe launched to explore the rings of Saturn would reach an average temperature near Saturn of about –183 °C. In addition to surviving the deep space harsh environment, electronics capable of low temperature operation would contribute to improving circuit performance, increasing system efficiency, and reducing payload development and launch costs. Terrestrial applications where components and systems must operate in low temperature environments include cryogenic instrumentation, superconducting magnetic energy storage, magnetic levitation transportation system, and arctic exploration.

An on-going research and development program on low temperature electronics at the NASA Glenn Research Center focuses on the development of efficient power systems capable of surviving and exploiting the advantages of low temperature environments. In-house efforts include the design, fabrication, and characterization of low temperature power systems and the development of supporting technologies for low temperature operations, such as dielectric and insulating materials, semiconductor devices, passive power components, opto-electronic devices, as well as packaging and integration of the developed components into prototype flight hardware.

An overview of the program will be presented in this paper, including a description of test facilities. Selected data from component testing will be discussed. Ongoing research activities that are being performed in collaboration with various organizations will also be presented.